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DISCOVERY

# Geo-spatial mapping of Wetlands and Sustainable Development in Niger State, Nigeria

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## ABSTRACT

This study presents the geo-spatial mapping of wetlands and sustainable development in Niger State, Nigeria. The importance of wetlands in the development of socio-economic and bio-resources availability of Niger State needs a critical investigation. Thus, Data for the study were imageries obtained from National Space Research and Development Agency (NASRDA). The NASRDA data were generated from soils and rock types as well as their water holding capacities across the three zones of Niger State to form the wetland areas using GIS approach. Findings indicated that the spatial spread of wetland in Niger State was highly present in Edati, Mashegu, Lavan, Bosso, Chachanga, Borgu. Wetland areas moderately decreased from the center to Shiroro, Paiko, Rafi, Kotangora, manga and Rija. Thus, wetland areas extended to the State boundaries of Gurara, Tafa, Sulaja and Munya. Greater part of the wetlands was formed from the segments of the northern drainage basin of the State. However, the effective use of wetlands will require increased wetland utilization, improved laws and regulations and greater dissemination wetland education for sustainable development of Niger State in Nigeria.

**Keywords**: Wetland, Utilization impairment, Sustainable development, Endanger, Protection

## 1. INTRODUCTION

Wetland has been known as a separate ecosystem that is constantly flooded by water. The soils of wetlands are usually saturated with water from season to season. Some wetlands retain water permanently throughout the year or on seasonal basis. Wetland soils are constantly saturated by water either temporarily or permanently. Wetlands are different from other ecosystems due their peculiar vegetation, water bodies and aquatic life, free oxygen in circulation and life-supporting system. Due to its unique nature, it serves as water filter, reservoir for flood and erosion, food for mankind and habitat for fish and wildlife species. It is a point of collecting excess carbon dioxide, sediments, nutrients, pollution and harbor for biodiversity. Wetlands serve as area for fishing and different forms of recreation. Wetland ecosystems are important environmental and natural resources contributing to the total wealth of a nation. However, because many of its services are not traded in the open markets and their values are not captured using the conventional approaches to valuation, they are usually ignored in the systems of national accounts. As a result, conventional measures of wealth give incorrect indications of the state of its well-being, leading to misinformed policy actions and poorly informed decision-making.

Basically, wetlands are areas dominated and saturated by water. They are areas where there is concentration of biodiversity of different plant and animal species. The water table of wetlands is near the land surface with high level infiltration and overflow of water as well as reservoir for flood retention. According to Barbosa (2009), wetlands were previously seen as dirty, dangerous and unimportant areas; while Barbosa (2010) opined that they are complex ecosystems hosting a high diversity of landscape associated with water, soil and vegetation variations. Wetlands are great resources for life on earth especially mankind who depend on wetlands for survival. Wetlands are habitats for different species of plants and animals on earth (Barbosa, 2010). Due to the high saturation of water in a wetland, it has become a life support system that supplies the water needs of the numerous biodiversity of plant and animals for their existence (Ramsar, 1998). Thus, Ramsar (1997) opined that wetlands possess different characteristics in the form of marsh, fen or peat lands that are created by natural or man-made processes. However, wetland areas have permanent or moving water of fresh water, brackish water and salt water having depth not exceeding six meters on the surface. Wetlands have their unique characteristics of soil for human development.

Due to the huge resources in wetlands, they have sometimes turned to be areas of strong depute among community stakeholders. Therefore, it has become imperative to design good wetland management framework for sustainable use of the abundant resources. According to Nigeria National Root Crops Research Institute (NRCRI, 1993; 1995), the awareness of dry season vegetable cultivation is growing in both north and southeastern agricultural zones of Nigeria. However, the wetlands are usually utilized in planting rice, sugar cane, cocoyam (*Colocasia spp)* and early yam *discorea spp* in the zone. Fishery is practiced along some river channels. The limited studies conducted on the wetlands in the some ecological zones were the river basins (Lekwa, 1986). River basin development authorities have reported the challenges of wetland in southern part of Nigeria (Enwezor et al. (1990). Also, some geological soil study however was understudied by Obaje, (2012) and Olasehinde (2010). Many wetland studies have been carried out by some scholars (Jungerius, 1964; FDALR 1985; Ohiri et al., 1989; Mbagwu, 1990). The objective of this study was to delineate and characterize the wetland soils utility and its impairment to development in Niger State. The results would serve as a management tool for sustainable wetland development and management.

Niger state is endowed with many river channels and good soil distribution from northern to the southern parts such as the Kainji basin, Niger trough, Mokwa-Baro basin, Gurara River basin and the River Kaduna basin. The distribution of these rivers reflects the nature of basins that have developed within the area. Although they all run through perennial river basins, but some are not perennial. Due to seasonal overflow of the rivers in Niger State, these watersheds only show-up during the raining season and dries off at the set in of the dry season. Very few among them that are used for irrigation farming, some of them are inviting but rather neglected to fallow without being cultivated. Therefore wetland utilization opportunities require more planning and detailed design work than most community projects, due to a combination of numerous factors. These factors include, significant rock and bedrock in the area, anthropogenic surface water influences and interferences, potential contaminant issues in soils and sediment, urban storm water inputs and the potential for contaminated storm water, multiple landowners and the developed nature of watersheds, community expectations, landowner expectations, the municipal regulatory system and questions relating to jurisdiction and urban infrastructure including roads, buildings, sidewalks, railways, storm water infrastructure, businesses, energy such as power poles and electrical systems as well as underground utilities such as gas lines, sewer lines, water lines etc. Therefore, this study endeavors to establish the challenges of wetland utilization impairment to sustainable development in Niger State.

## 2. MATERIALS AND METHODS

### 2.1. Description of Study Location

Niger State is about 65% covered by drainage basins of different categories ranging from seasonal streams and springs to perennial rivers and their tributaries. Most areas that are not good to flood are either outcropped with rocks or underlining rocky areas towards the northern plains of the state. Niger State is situated in the north-central geopolitical zone of Nigeria, located between latitude 8.30° to 11.30° N and longitude 3.30°to 7.30° Eof the equator having zones A, B and C. It is bounded in the south by Niger River, the Federal Capital by the eastern border and the republic of Benin at the western border, Zamfara and Kaduna States at the north-west and northern parts respectively. Niger State occupies land area of 76,363 km$^2$ (29,484 sq mi) (Figures 1 and 2).Niger State experiences 1600mm to 8000mm of rainfall annually which decreases northwards with the pick between July and August with temperature of 24° to 37° having the highest in March.


**Figure 1:** Niger State in Nigeria

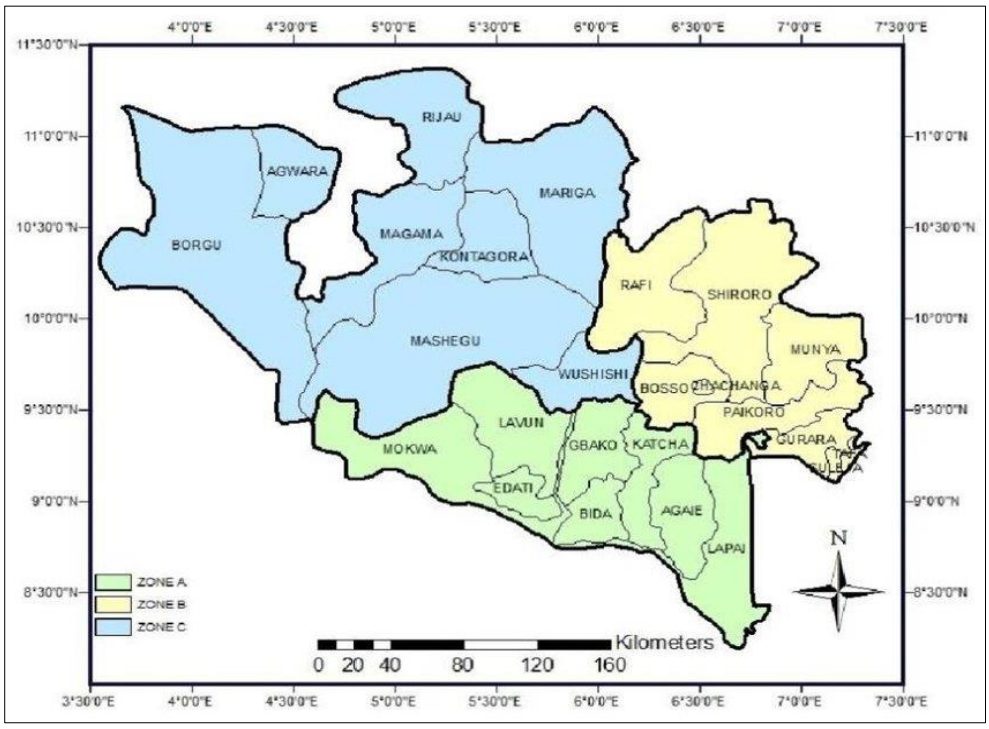


**Figure 2:** Three Zones of Niger State

### 2.2. Methods of Data Collection

Data for the study were imageries obtained from National Space Research and Development Agency (NASRDA). The NASRDA data were generated from soils and rock types as well as their water holding capacities across the three zones of Niger State to form the wetland areas using GIS approach. Thus, the NASRDA data captured streams and rivers forming different catchment basins and wetland areas in Niger State (Figure 3).

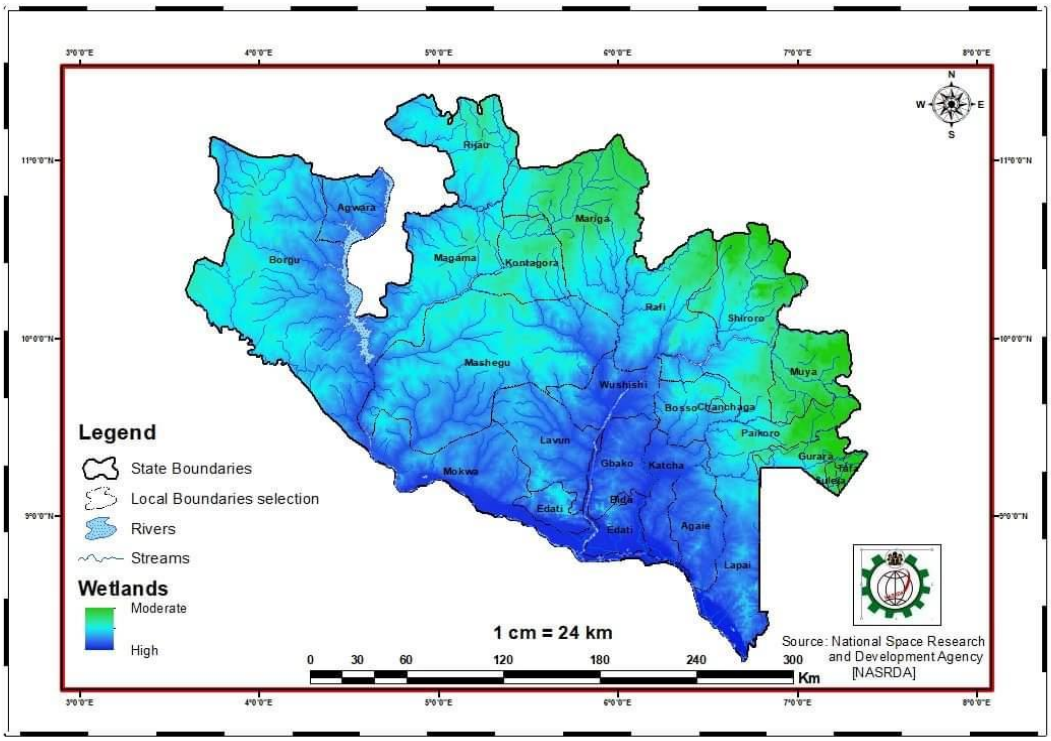


**Figure 3:** Drainage Basin in Niger State (Source: NASDA, 2019)

## 3. RESULTS AND DISCUSSION

Niger State is divided into three zones namely A, B, C made up of different Local Government Areas (LGAs). Zone A is made up of Mokwa, Lavun, Edati, Gbako, Bida, Katcha, Agaie and lapai. Zone B is made up of Rafi, Shiroro, Bosso, Chachanga, Munya, Paikoro, Gurara, Suleja and Tafa. Zone C is made up of Wushishi, Mashegu, Kontagora, Mariga, Magama, Rijau, Borgu and Agwara respectively (Figure 2). The spatial spread of wetland in Niger State indicated that there was high presence of wetlands in Edati, Mashegu, Lavan, Bosso, Chachanga, Borgu. Wetland areas moderately decreased from the center to Shiroro, Paiko, Rafi, Kotangora, manga and Rija (Figure 4). Thus, Wetland areas extended to the State boundaries of Gurara, Tafa, Sulaja and Munya. Greater part of the wetlands were formed from the segments of the northern drainage basin of the State. The wetlands developed from tributaries and rivers which had drained the soils and rocks at flood saturation levels. It was observed that the inner part of the State had high wetland coverage than the fringes. There were LGAs with no presence of wetlands such as Lapai, Agaie, Edita, Bida, Katcha, Gbako, Wushishi, Mokwa, Agwara; though these LGAs had the presence of river networks. The LGAs at the southern borders of the State had no presence of wetlands. Also, the western segment of the State had the presence of wetlands but relatively low compared to the eastern segment. The distribution of drainage basins and wetlands in Niger State showed that the State had the water resources for hydro-electric power generation. The study area showed the enormous distribution of abundant ecosystems and biodiversity for modern biotechnology.

Wetlands has irreplaceable role in regulating the global climate, maintaining the global hydrological cycle, protecting the ecosystem diversity and safeguarding human welfare (Ramsar Convention Bureau, 2001). The value per hectare of wetland ecosystem services rank first among all kinds of ecosystems and the total values of wetland services account for about 47% of the values of the global ecosystem (Costanza et al, 1997). Therefore, it is one of the most important and productive ecosystems. Due to the dual effects of human activities and natural factors, the wetland areas are said to be decreasing and the quality deteriorating. In

the study area, most of the services provided by wetland ecosystems have not been traded in the economic market; the values are continually neglected and underestimated by stakeholders, government and the public.

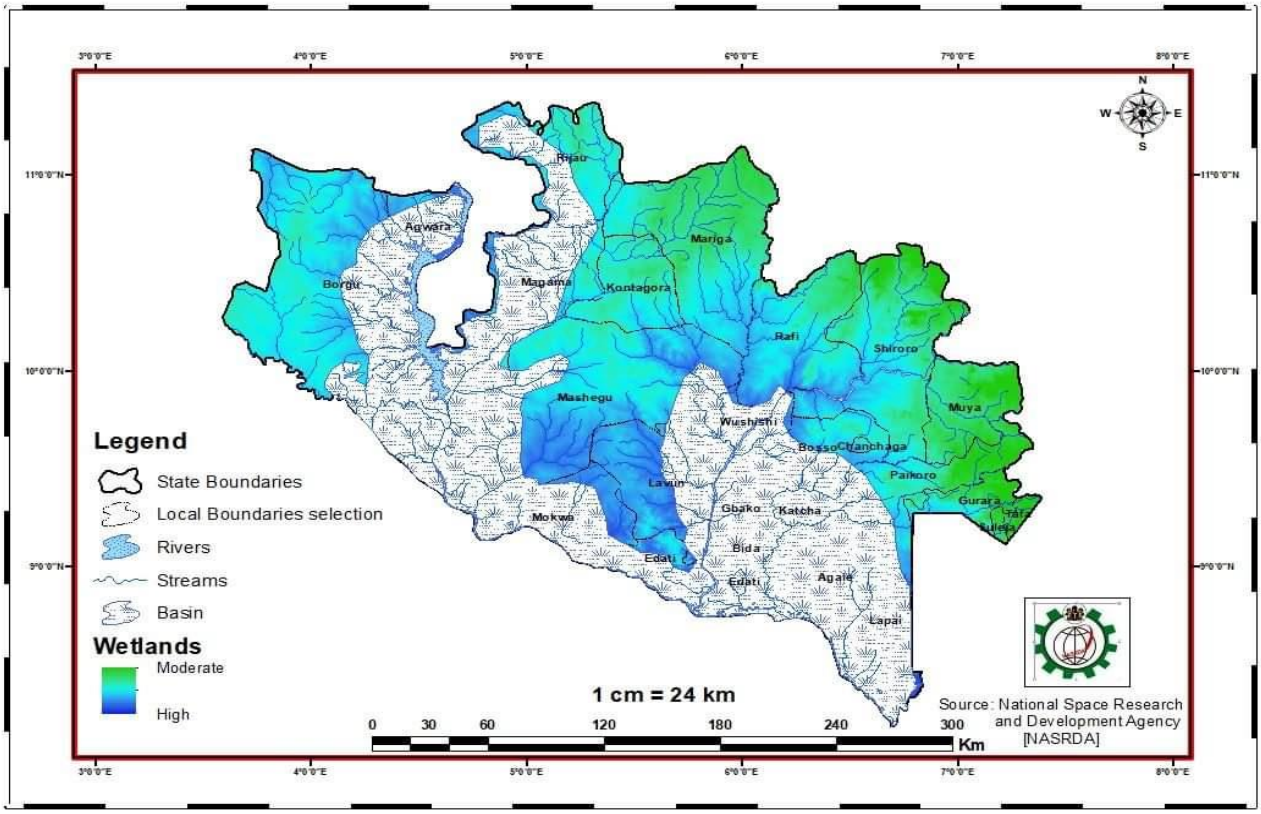


**Figure 4:** Spatial Distribution of Wetlands in Niger State (Source: NARSDA, 2019)

The present status of wetland utilization are in the forms of lack of public awareness on the need for wetland; insufficient funding for wetland utilization and management; an imperfect legal system to use wetlands; insufficient wetland research; lack of coordination among agencies and unclear responsibilities as well as undeveloped technologies related to wetland use and protection. These rich agricultural resources pose high degree of importance to the community by serving as multipurpose services. But on the ground that the community cannot put it to use it becomes wild and abandoned. This is the situation in Niger State where vast areas are abandoned of the wetland biodiversity.

## 4. CONCLUSION

Niger State has vast amount of surface and groundwater resources that are being sustained by wetlands. The benefits provided by wetlands are quite enormous with increased importance to the people in terms of the availability of bio-resources. Many wetlands have been greatly destroyed and altered as a result of anthropogenic activities resulting from mining exploration and exploitation, therefore the need to develop an approach for monitoring wetland is necessary in order to identify, plan and implement proper management response to affected sites. Industries like agriculture should improve their management practices to reduce the effects of non-point source pollution on wetlands and surrounding environments. In Niger State, the government and communities of the rural settlers around the rivers should establish associations that will open up land for cultivation of crops like palm trees, rice, bananas, maize and root crops like cassava, yams, cocoa- yam and tree crops such as mangoes, oranges, guava and many other crops. Adequate measures like dredging, clearing, mix-cropping and shifting cultivation can be employed in the use of wetland areas. This is the time government and other development practitioners should design a wetland management framework for sustainable growth of Niger State of Nigeria.

**Conflicts of interest**

None

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